

# Anatomical Variation of Colon Detected on Abdominal Computed Tomography Correlated with Gender

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## ABSTRACT

### Introduction:

Anatomical variation of the colon can cause diagnostic dilemmas and pose a problem while radiological interpretation and during various procedures. Radiologists and clinicians should exert much caution during the procedures in such patients. This study was done to study the anatomical variation of the colon in abdominal CT scans and correlated the variations with gender.

### Methods:

It was a cross-sectional study done at the Department of Radiology and Imaging of Manipal Teaching Hospital from September 2020 to March 2021. Abdominal CT was obtained and colonic position was evaluated. The Chi-square test was applied to assess the correlation between colonic variations and gender.

### Results:

There were 388 patients in total. The age of the patients ranged from 3 years to 94 years. The mean age of the patients was 44.8±18.6 years. There were 166 (42.8%) females and 222 (57.2 %) males. Out of 388 patients, 170(43.8%) had some colonic anatomical variations. Sixteen (4.1%) patients had retro gastric colon. Around 6% had a right retrorenal colon and 30(7.7%) had a left retrorenal colon. Seven (1.8%) patients had anterolateral hepatodiaphragmatic interposition. Forty-two patients (10.8%) had high positioned caecum. The redundant sigmoid colon was present in 38(9.8%) patients. There was no significant correlation between the colonic variation and gender.

### Conclusion:

Different variations in the colon exist even in the Nepalese population, of which the radiologists, as well as the surgeons, should be aware.

**Keywords:** Colon; Nepal; Tomography, X-Ray Computed

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## INTRODUCTION

Positional anomalies of the colon are caused by an arrest in the normal development of the distal midgut. Colon anatomical variations can be acquired or can result from embryological aberration. Embryologically, it may be due to the process of intestinal rotation or due to the process of intestinal fixation. This variation may not necessitate an immediate diagnosis because the majority of them have no acute clinical significance but variations can manifest as ill-defined, long-lasting, and intermittent abdominal pain. Other congenital and acquired anomalies may also be linked to colonic variations. The colon may be perforated during percutaneous renal interventions and surgical procedures.<sup>1-4</sup> So, a thorough knowledge of colonic variations is helpful during the management of the patient and surgical procedures like percutaneous nephrostomy. Without its knowledge, there is also the likelihood of misinterpretation of radiological images. There is a relative paucity of data regarding colonic variation from Nepal. Hence, this study was done to study the anatomical variation of the colon in abdominal CT scans and correlated the variations with gender.

## METHODS

It was a cross-sectional study done at the Department of Radiology and Imaging of Manipal Teaching Hospital from September 2020 to March 2021. Ethical clearance was obtained from the institutional review board before commencing the study. All patients attending the Radiology department for abdominal computed tomography (CT) scan were included in the study. Written and informed consent was obtained from all the patients before the data collection. Abdominal CT was done based on the standard protocol. Abdominal CT was obtained and colonic position was evaluated. Patients who had bowel mass, mesenteric and ovarian mass, and had undergone splenectomy were excluded from the analysis because of the possible anatomical changes brought about by them. Similarly, patients with ascites, given that free fluid creates a space between the liver and the diaphragm into which the bowel can easily migrate were also excluded from

statistical analysis. Data related to age and sex were collected. All categorical data were expressed in percent and absolute numbers. The Chi-square test was applied to assess the correlation between colonic variations and gender. All tests were analysed with a 95% confidence interval and a p-value of <0.05 was considered significant. The data analysis was done using Statistical Packages for the Social Sciences 20. (IBM Corp. Released 2011. IBM SPSS Statistics for Windows, Version 20.0. Armonk, NY: IBM Corp.)

## RESULTS

A total of 420 patients were included in the study, among them, 20 patients had ascites, eight had ovarian mass, two had mesenteric mass, and one had bowel mass and splenectomy. They were excluded from statistical analysis. So, a total of 388 patients were included for statistical analysis.

The minimum age of the patient was 3 years and the maximum age was 94 years. The mean age of the patients was  $44.8 \pm 18.6$  years. There were 166 (42.8%) females and 222 (57.2 %) males.

Out of 388 patients, 170(43.8%) had some colonic anatomical variations while 218(56.2%) patients had no variations. Sixteen (4.1%) patients had retro gastric colon. Out of these, 9(2.3%) had retro pancreatic colon and 7(1.8%) had retro splenic colon.

Out of the total, 23(5.9%) had a right retrorenal colon and 30(7.7%) had a left retrorenal colon. Seven (1.8%) patients had anterolateral hepatodiaphragmatic interposition. Forty-two patients (10.8%) had high positioned caecum. The redundant sigmoid colon was present in 38(9.8%) patients.

Regarding transverse colon variations, 303(78.1%) patients had standard transverse colon, 36(9.3%) had twisted type of transverse colon, 27(7%) had U-shaped transverse colon and 22(5.7%) had V-shaped transverse colon.

There was no significant correlation between the colonic variation and gender ( $p=0.79$ ).

**Table 1: Correlation between colonic variation and gender**

Gender	Colonic Variations		Total
	Absent	Present	
Female	92 (55.4%)	74 (44.6%)	166 (100%)
Male	126 (56.8%)	96 (43.2%)	222 (100%)
Total	218	170	388

p = 0.79

## DISCUSSION

Colon variation is important, especially from a radiological and surgical perspective. The major colonic variations are due to irregular or defective development.<sup>5</sup> Out of 388 patients, 23(5.9%) had right retrorenal colon and 30(7.7%) had left retrorenal colon. Unal et al. observed retrorenal colon in 1.2%.<sup>1</sup> Retrorenal colon has been reported in 1% of cases by Morse et al. and Sherman et al.<sup>6,7</sup> But Faure et al. observed laterorenal position of the colon in 60% of cases.<sup>8</sup> They observed no retrorenal position of the colon.<sup>8</sup> Thought rare, accidents by trans colic puncture are more common with posterolateral position of the colon concerning the kidney. This position seems to be more frequent in young females.<sup>6,9,10</sup> We had no significant correlation between colonic variation and gender.

The interposition of the colon on the right side of the upper abdomen is called hepatodiaphragmatic interposition. It is a rare anomaly reported only in 0.25–0.28% of the general population.<sup>11</sup> This anomaly, also called Chilaiditi syndrome was described by Chilaiditi.<sup>11-13</sup> In our study, 7(1.8%) patients had anterolateral hepatodiaphragmatic interposition. Unal et al. observed hepatodiaphragmatic interposition in 2.1%.<sup>1</sup>

The left flexure could also be found between the spleen and diaphragm in agenesis or anomaly of the diaphragm (congenital diaphragmatic hernias).<sup>14</sup> Ectopic left kidney and small intestinal masses may cause displacement of the left colon flexure laterally.<sup>14</sup> Splenodiaphragmatic, retrosplenic or splenorenal interposition of the colon has not been reported in detail.<sup>15,16</sup> Oldfield and colleagues reported a retrosplenic colon in 0.03%.<sup>15</sup> Oyar et

al. observed retrosplenic colon in 0.3%.<sup>17</sup> In our study, 16(4.1%) patients had retro gastric colon. Out of these, 9(2.3%) had retro pancreatic colon and 7(1.8%) had retro splenic colon. Unal et al. observed a retrogastric colon in 0.6% of cases, in which, one had pancreatic gastric and another one had a retrosplenic colon.<sup>1</sup> It has been suggested that a retrosplenic colon could be seen after left nephrectomy, in renal agenesis or renal ectopia.<sup>14</sup> In our study, we did not find any anomalies in the kidneys or other surroundings organs in cases with retrosplenic colonic variation. Oldfield et al. and Oyar et al. also did not find any such anomalies in the case of retrosplenic colonic variation.<sup>15,17</sup> It is important to identify the abnormal position of the transverse and descending colon during splenectomy.<sup>17</sup>

Several factors have been attributed to the anatomical variation in the shape and position of the transverse colon, which is, the length of the large intestine, increased mobility, the length of the transverse mesocolon, and the position and angle of the colic flexures.<sup>18</sup> Regarding transverse colon variations in our study, 303(78.1%) patients had standard transverse colon, 36(9.3%) had twisted type of transverse colon, 27(7%) had U-shaped transverse colon and 22(5.7%) had V-shaped transverse colon.

The subhepatic position of the caecum is very rare. It results due to the anomaly in fetal gut rotation.<sup>19</sup> In the case of subhepatically located caecum with appendicitis, the inflammation mimics hepatobiliary or gastric pathology clinically which poses a diagnostic challenge. Hence there is a high chance of delayed diagnosis and complications.<sup>19</sup> In such cases, radiologic imaging is of utmost importance. We observed high positioned caecum in 10.8% of our patients, higher than that observed by Unal et al., which was 4.2%.<sup>1</sup>

The redundant sigmoid colon was present in around 10% of our patients. Right-sided descending and sigmoid colon has been reported by Shrivastava et al.<sup>20</sup> Madiba et al. noted the sigmoid colon to be longer, and the sigmoid mesocolon root was narrower in Africans compared with the other population groups.<sup>21</sup> Sigmoid colon was reported to

occupy the right lower quadrant in 35% of children in a study done in India but all the patients included in their study were suspected to have large bowel disease.<sup>22</sup> But conventionally, the sigmoid colon is believed to occupy the left lower quadrant.<sup>23,24</sup> We observed a sigmoid colon to occupy the left lower quadrant. Sigmoid colonic malposition poses problems during investigation, diagnosis, and intervention.<sup>20</sup> There is much clinical significance in the identification of the correct position of the sigmoid colon during the interpretation of plain radiographs of the abdomen. When the sigmoid colon is situated in the right iliac fossa, gas in the right sigmoid loop can be mistaken for caecal gas. Another importance of its correct identification of the position of the sigmoid colon is for assessing the result of percutaneous reduction of intussusception while performing percutaneous cecostomies and during the anterior transperitoneal approach of the kidney.<sup>8</sup> Therefore, intervention radiologists should be aware of such variations to avoid inadvertent colonic puncture during such procedures.

## CONCLUSION

Different variations in the colon exist even in the Nepalese population, of which radiologists, as well as surgeons, should be aware. Utmost care should be taken during radiological interpretation or during surgical procedures like percutaneous nephrostomy, or splenectomy if such variation exists. A large population-based study is indicated to get a true picture of colonic variation in our population.

## CONFLICT OF INTEREST

None

## SOURCES OF FUNDING

None

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